Response letter

Dear Editor and Reviewers,

We are grateful for the comments and suggestions from the editors and the reviewers, which are crucial for improving our work. We have revised the manuscript to address the reviewers’ comments fully. Our point-by-point reply to the review comments is summarized below. In this document, the original reviewers’ comments are in **black**; our responses are in **blue**; the quotations in the revised manuscript are in **red**.

Reviewers' comments:

EiC: While you are revising your paper, here is a list of points worth checking, which we find author's overlook. I will check that these are adhered to before your paper is approved for publication, assuming the revision satisfies the Associate Editor and Reviewers.

Reply: Thanks. We have double-checked and revised the manuscript according to the list below from the editor-in-chief.

a) Make sure your title is succinct and grammatical. It should ideally not exceed 10-15 words.

Reply: Thanks for your suggestion; our current title, ‘AGMN: Association Graph-based Graph Matching Network for Coronary Artery Semantic Labeling on Invasive Coronary Angiograms,’ has 15 words precisely conveying the scope of our work.

b) Make sure your conclusions reflect on the strengths and weaknesses of your work, how others in the field can benefit from it and thoroughly discus future work. The conclusions should be different in content from the abstract and be rather longer too.

Reply: Thanks for the suggestion. Our current form of the conclusions follows the suggestions of the editor-in-chief. Specifically, we included a summary of our findings, discussed limitations, and outlined future work.

c) Take a careful look at your bibliography and how you cite papers listed in it. Make sure it is current and cites recent work. Please cite a variety of different sources of literature. Please do not make excessive citation to arXiv papers, or papers from a single conference series. Do not cite large groups of papers without individually commenting on them. So we discourage " In prior work [1,2,3,4,5,6] …". Your bibliography should only exceptionally exceed about 40 items.

Reply: Thanks for the suggestions. We have checked the reference section to meet the publication requirements. Besides, we have added several references accordingly and corrected the format of the citations.

d) You may have originally written your paper with a different audience in mind. Please make sure the revised version is relevant to the readership of Pattern Recognition. To this end, please make sure you cite RECENT work from the field of pattern recognition that will be relevant to our readership.

Reply: Thanks for the suggestion. Our study is related to deep learning on the graph and medical image processing for coronary arteries semantic labeling using invasive coronary angiograms, aiming at the potential readers in pattern recognition, especially for the special issue of ‘Graph Machine Learning.’

e) Do not exceed the page limits or violate the format, i.e. double spaced SINGLE column with a maximum of 35 pages for a regular paper and 40 pages for a review.

Reply: Our paper has a total number of 28 pages which meets the publication requirements.

GE: One reviewer still has ONE concern on the manuscript which should be addressed before recommend for publication. Based on the review reports, my recommendation is Minor Revisions.

Reply: We would like to extend my appreciation to the editorial team for their support throughout the review process. The commitment to maintaining the quality and rigor of the journal is commendable. And thank you for recognizing the significance of my research. The response to this question is shown below.

**Reviewer #1**: Notes to the Reviewer : This field is mandatory. Please put here your comments explaining your ratings of the paper and suggesting improvements

**Reviewer #2**: The article has been revised very well, it is recommended to accept.

Thanks for your previous constructive comments and valuable suggestions, which have immensely contributed to improving the quality of my research. We are thankful for your time and effort in carefully reviewing our manuscript and providing such thoughtful recommendations.

**Reviewer #4:** In this The authors answered my questions carefully. The revision has better readability than the original. The only one limitation is the complexity of the calculation. I suggest to accepting it.

Thanks for your constructive comments and recommendation. Evaluating the complexity of a deep learning model involves assessing various aspects related to its architecture, size, and computational requirements. Belows are common measures used to evaluate the complexity of a deep learning model.

1) Number of Parameters. The number of parameters indicate the total number of learnable weights in the model. Generally, models with a higher number of parameters tend to be more complex.

2) Computational Complexity. The computational complexity indicates the number of operations required for a forward pass of the neural network. Complex models often require more computations, leading to higher training and inference times on GPU. Typically, Floating-Point Operations (FLOPs) is used to represent the computational complexity. It provides a measure of the computational complexity of the model, which is irrelevant to computer hardware.

3) Memory Usage. The memory usage of a deep learning model refers to the amount of memory required to store intermediate activations and gradients during the forward and backward passes during the model training. A model with less GPU RAM comsumption is much easier to be trained and deployed into the real environment.

4) Training and inference time.

We reported the number of weights, FLOPs, V-RAM comsumption, training time and inference time for each model using the same workstation, as shown in Table 6 in the revised version.

**Table 6**. Comparison of the computation complexity, training time, and inference time between our AGMN and existing models for coronary artery semantic labeling using ICAs

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Method | Number of weights | FLOPs | V-RAM (GB) | Training time (hours) | Inference time (seconds) |
| SVM | - | - | - | 0.01 | 0.001 |
| UTD | 18.323K | 118.696K | 2.032 | 0.25 | 0.008 |
| DTU | 18.323K | 118.696K | 2.032 | 0.25 | 0.008 |
| BiTreeLSTM | 25.793K | 129.019K | 2.032 | 0.50 | 0.016 |
| CPR-GCN | 2.460M | 40.049M | 2.118 | 9.60 | 0.415 |
| Our AGMN | 296.612K | 954.097K | 1.270 | 6.10 | 0.613 |

Also, we modified the discussion of the computation complexity. And section 4.7 now reads:

To evaluate the model complexity, we compared the number of weights, Floating-Point Operations (FLOPs) and V-RAM consumptions for each model in Table 6, except for the machine learning-based model. The FLOPs represent the number of floating-point arithmetic operations performed during a forward pass through the model. For the BiTreeLSTM, UTD, and DTU models, we set the hidden layer with a size of 128 and the LSTM layer with a hidden size of 30. Under this setting, the number of weights was only 18.323K to 25.793K. The CPR-GCN contains the MLP layers for positional feature extraction and CNN and LSTM layers for imaging feature extraction. In our implemented CPR-GCN, three MLP layers were used for positional feature extraction, a convolutional bi-directional LSTM (CBiLSTM) was employed for imaging feature extraction, and a GNN with two GCN layers was used for feature aggregation. The number of weights and required FLOPs for CPR-GCN was 2.46M and 40.049M, which was 7 and 42 times larger than that of AGMN. Our AGMN only contains MLP and GCN layers, so limited weights and FLOPs were required. Though with a limited number of weights and limited FLOPs, our model achieved the highest coronary artery semantic labeling performance. In addition, our AGMN only requires 1.27GB of V-RAM, indicating the advantage of our AGMN is a compact model and can be deployed in real environments with limited computational resources. The implementation details of the baseline models are provided in supplementary materials.